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## THE GLENOID FOSSA IN THE SKULL OF THE ESKIMO

by

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*The Glenoid Fossa in the Skull of the Eskimo.*

By F. H. S. Knowles.

The glenoid fossae in the human skull are concave depressions on the basal aspect of the temporal bones. Each fossa is divided into two parts by the Glaserian fissure; the anterior portion concave, smooth, and bounded in front by the eminentia articularis, serves for the articulation of the condyle of the lower jaw; the posterior portion, rough and bounded behind by the tympanic plate, serves for the reception of part of the parotid gland. It is with the anterior portion that I intend to deal, and my object in this paper is to show that in the skulls of those Eskimo who have existed under the primitive conditions of life habitual to their race, the surface for articulation with the mandible is not deeply concave as in the skulls of modern highly civilized races, but tends on the whole to be shallow, and in many instances very remarkably so. I have examined numbers of skulls belonging to various primitive races and in many of them one can pick out crania presenting flattening of this fossa in a more or less marked degree. W. L. H. Duckworth in his "Studies in Anthropology," page 107, notes in his description of some aboriginal Australian crania in the Cambridge University Museum: "It is here to be remarked that the glenoid fossae of this specimen (No. 2137) are very shallow and flattened, the flattening being most pronounced in the region of the an-

terior border of the cavity so that the anterior root of the zygoma is indistinct. It is submitted that such a shallow glenoid fossa is an approach to a state that is usual in anthropoid apes; (among Australian crania Nos. 2138, 2139, 2140, exhibit the same feature in a less marked degree)." I myself have noted this glenoid flattening, exemplified in a most remarkable manner, in some New Caledonian crania belonging to the Williamson collection in the Museum of the Royal Army Medical college, London; indeed, it was during an examination of these crania that my attention was first called to this peculiarity. I have also noted this condition in the skulls of other races living under primitive conditions, but in most of them it would seem to be probably a local and no doubt in some cases an individual characteristic; one can, for example, find many Australian crania with deep, well marked, glenoid fossae and the same remark applies to other races. When, however, one examines a series of Eskimo skulls, one is at once struck by the almost uniformly shallow appearance of these fossae; it seems, indeed, to be the exception to find in an Eskimo skull a very concave glenoid fossa, whilst many of them present an extreme appearance of glenoid flattening.

When an examination is made of the glenoid fossa in any skull which exhibits this shallow form, it becomes evident that this appearance is due most largely to the rolling and flattening out in the forward and outward direction of the eminentia articularis, as well as perhaps to a relatively lesser depth of fossa. Hence, in extreme cases, such as in figure 3, Plate II, the eminentia articularis merges into the fossa in a continuous straight line, while the fossa itself is wide and shallow. In intermediate forms, such as figure 6, Plate II, the eminentia, although considerably flattened, yet is still slightly curved, while the 'anterior concave portion' of the fossa can now be recognized. The glenoid fossa in the skulls of modern civilized man, presents a very different appearance to this: the eminentia is high and prominent, while the concave portion is deep and very clearly defined. See diagram, Plate I, and figures 1 and 2, Plate II.

Now C. S. Tomes, in his "Dental Anatomy," points out the influence of different methods of mastication upon the form

of the glenoid cavity; he writes: "The form of the glenoid cavity . . . . bears an intimate relation to the dentition of the animal and the nature and extent of the movement of the jaws. Thus in a child it is nearly flat with no well marked surrounding elevations, its axis is transverse and little rotary motion is made use of. In the adult it is deeply sunk, the axis of the condyle is oblique and rotary movements are largely made use of in triturating food. In the felidae it is strictly transverse, their teeth adapted for slicing but not grinding, would gain nothing by lateral motion, which is rendered quite impossible by the manner in which the long transverse condyles are locked into the glenoid cavity by strong processes in front and behind . . in Herbivora the condyle is roundish, the ascending ramus long, the pterygoid muscles large and the glenoid cavity shallow. In the whale, which of course does not masticate at all . . the articulation is reduced to a mere ligamentous attachment." Here, then, I think we have the key to our problem, and that we shall find that it is to some differences in the method and extent of mastication that is due the distinction in the form of the glenoid fossae between civilized and primitive man. Since, therefore, in the Eskimo we have a race which seems most uniform in the display of glenoid flattening, we will take them as the champions of the "shallow-glenoid" type, and examine, first, the conditions of their life and the nature of the food they have to masticate, and, secondly, the form of the masticatory apparatus presented in their skulls.

Now it is well known that the staple diet of the Eskimo is of a more or less purely animal nature, fish, flesh, and fowl being their main means of subsistence, while, to judge from all accounts, much of the meat they eat must be of a very tough nature; so that, on the whole, we could not find any other race of the present day in which there would be so much need for strong jaws, and so much need too to use them in such a manner that their food should be thoroughly triturated before being swallowed. A few extracts from the writings of authors who have lived among and studied the Eskimos will perhaps be of use to emphasize my point, and give confirmation to my statement as to the nature of the Eskimo's food.

Fridtjof Nansen in his "Eskimo Life" writes: "Meat and fish are eaten sometimes raw and frozen, sometimes boiled, sometimes dried . . . . Among other dainties I must mention the skin (matak) of different sorts of whales, especially of the white whale and porpoise, which is regarded as the acme of deliciousness. The skin is taken off with the layer of blubber next to it, and is eaten raw without further ceremony . . the skin is as tough as India-rubber to masticate, so that the enjoyment can be protracted to any extent . . A delicate dish which does not however rival matak, is raw halibut skin. It has the advantage that, by reason of its toughness, it goes such a long way . . ." "The Greenlander is also very fond of raw seal skin with the blubber." In another place again in describing their physical characteristics he writes: "He has a . . broad mouth; heavy, broad jaws; which, together with the round cheeks, give the lower part of the face a great preponderance in the physiognomy. When the mouth is drawn up in an oleaginous smile two rows of strong white teeth reveal themselves. One receives the impression, upon the whole, of an admirable chewing apparatus. . . . ." Another author, Mr. H. Whitney[1], relating his experiences among the Highland or Northernmost Eskimos, writes: "While Eskimos eat much of their meat raw and relish it so, they prefer it cooked when conditions permit of cooking. It can be understood how difficult it is to cook it when it is remembered that the only fire they possess is the one supplied by the stone lamps." "The skins (of the little auk) are first thoroughly dried, then the women chew the flesh side until all oil is extracted and the skin is soft and pliable and ready to be sewn into the garment with sinew. In preparing seal and other skins for sewing the women always resort to the chewing process." "The main feature of the feast was an uncooked meal." "They get sustenance too by eating hard frozen raw walrus and seal meat or blubber." "A stone lamp was set up, but the seal blubber frozen hard had to be thawed before it could be burned. This was done by the Eskimos chewing and spitting it when softened, into the lamp." "Even little

[1]See "Hunting with the Eskimos," by H. Whitney.

youngsters, some of them not yet over three years of age chewed the dripping meat and blubber." (This meat and blubber was raw and the author was there describing the scene of feasting after the killing of some seals). Lastly, "Very small tots might be seen at any time chewing pieces of raw seal or walrus meat."

This will be enough to show the nature of the food of these people and how very essential it must be for them to be provided with strong jaws and with biting and chewing muscles correspondingly large and powerful. When we examine a series of skulls of adult Eskimo, we have ample evidence that our conclusions from the nature of their food, are borne out by the form of their jaws and the muscle attachments on their skulls. An Eskimo's jaws are essentially of a biting and chewing type. The extent for the attachment of the temporal muscles on the sides of the skull is very great, being on the whole more marked in the skulls of this race than in any other of the existing races of man. The external pterygoid plates are large; this is noted in a paper by J. Brierley and F. G. Parsons.[1] "The external pterygoid plate is very broad antero-posteriorly. This is probably due to the development of the pterygoid muscles." This is important since the external pterygoid muscles are the chief agents in the lateral movements of the mandible and, as I shall endeavour to show, it is just this lateral triturating movement when practised early and extensively, that is of importance in its flattening effect on the glenoid fossa. The zygomatic arches and malar bones are large and projecting. Especially is the form of the mandible noteworthy (see Plate III); the ascending ramus is low, broad, and strong, the area for insertion of the masseter and pterygoid muscles being well marked and very extensive. Now the superficial portion of the masseter muscle assists the external pterygoid in drawing the lower jaw forward upon the upper, the jaw being drawn back again by the deep fibres of the masseter and posterior fibres of the temporal. The marked development of the masseter and the posterior fibres of the temporal muscles in the

[1] See "Notes on a Collection of Ancient Eskimo Skulls," Journ. Anthr. Inst., 1906.

skulls of these people is, therefore, further evidence of the activity and extensive movements of their mandibles during the process of mastication. Lastly, the coronoid process is low and very stout, and its distance from the condyle renders the leverage of the temporal muscle on the mandible still more effective.[1]

Dr. Ales Hrdlicka[2] remarks upon the great development of the jaw muscles in the skulls of the Eskimo, with especial reference to the size and strength of the temporal muscles and their probable effect upon the shape of the skull. He also notes the great breadth of the ascending ramus of the mandible, strong coronoid process, and, in certain of the lower jaws examined by him, "remarkable individual variations, due to a great development and activity of the masseter muscles." From this very instructive paper I will quote the following paragraph (page 211), as it is of exceptional interest in the present connexion:—

"The lower jaw presents a moderate to fairly prominent, and not rarely square chin, medium height, very strong build, and broad ascending branches. A marked and general feature is a pronounced bony reinforcement of the alveolar arch extending above the mylo-hyoid line from the canines or first bicuspids to or near the last molars. This physiological hyperostosis presents a more or less irregular surface and is undoubtedly of functional origin, the result of extraordinary pressure along the line of teeth most concerned in chewing, yet its occurrence in infant skulls indicates that at least to some extent the feature is already hereditary in these Eskimos."

When we turn to the shape of the palate we find still more evidence, both as to the severe nature of the work which the jaws are called upon to perform, and also the chewing method which has evidently been of most service in its accomplishment.

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[1] See "A consideration of some of the more important factors concerned in the production of man's cranial form," by Prof. A. Thomson, Journ. Anthr. Inst., 1903.

[2] See "Contribution to the Anthropology of Central and Smith Sound Eskimo," American Museum of Natural History, Vol. 5, Pt. 2. (Anthropological paper).

Here, however, it will be necessary to make a slight digression, as some views of Dr. Keith[1] help to throw much light on the present investigation. He remarks that in all anthropoid forms, both recent and extinct, the canine teeth are so developed that a side to side grinding movement in mastication is impossible; that the canine teeth are developed to prevent such a movement, and that they serve as guides to prevent the jaws from "skidding" or slipping when brought forcibly into action; that in crushing their food, the lower teeth ascend more or less forcibly against the upper.

Dr. Keith then goes on to show that in Mousterian man the form of the palate had far departed from the anthropoid type, and that this departure, made possible by the subsidence of the canine teeth to the level of their neighbours, was due to the evolution of a new form of mastication, namely, a side-to-side chewing movement. Now the palate of Mousterian man was remarkable for its horseshoe shape and its relatively great width, while the dental roots of the Mousterian race were highly specialized. The roots of the teeth from St. Brelade bay, Jersey, were remarkable for their fusion due to the great hypertrophy of their dentine and cementum and, as Dr. Keith has pointed out, it seems clear that these features were due to the side-to-side grinding movement in mastication, "the fusion of the roots being a result of overgrowth to withstand the great lateral strain thrown on the teeth in a side to side mastication," whilst "the great width of the palate was also due to the preponderance of the side to side movement." . . . . "In modern races," on the other hand, "especially highly civilized races, a modified form of the anthropoid bite has reasserted itself. In place of the canines serving as guides to prevent a side to side movement the lower incisors bite and pass upwards behind the upper; the incisor teeth serve to insure a vertical and scissor-like action of the teeth. With the evolution of the modern and overlapping bite and diminution of the side-to-side movement there is a tendency to narrowing of the palate."

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[1] See a description of teeth of palæolithic man from Jersey by A. Keith and F. H. S. Knowles, Journ. Anat. and Phys., Vol. 46.

I have quoted Dr. Keith's views at some length, for I think that it is by reference to a strongly developed side-to-side movement of the mandible in mastication that we can explain the shallowness of the glenoid fossa in the Eskimo, while to the diminution of this movement, the deep fossa in modern man may be attributed. In the matter of diet, the conditions under which Mousterian man lived were much the same as for the Eskimo of the present day. He was essentially a hunter and subsisted mainly on the flesh of animals killed by him, and it must have been very often tough flesh too, if one may judge from the bones left as evidence of his feasts; cave-bear, wild horse, reindeer, mammoth, rhinoceros, and bison, seem to have been represented among his foods[1], while we have no reason to believe that his cookery was of anything but an exceedingly primitive nature. Should further evidence be needed, we have it in his enormously powerful jaws and the correspondingly extensive muscular impressions upon his skull. If, therefore, Mousterian man found it necessary to specialize in this side-to-side masticatory movement of the jaws in order to cope with the tough nature of his food, and seeing that it had also had this secondary effect upon the form of his palate and the roots of his teeth, we shall not be surprised, I think, to find evidence of the same masticatory method, accompanied by its secondary effects, in the skull of the Eskimo. We have already seen from our inquiry into the diet of these people that their ordinary food is of such a nature as to need a most thorough and workmanlike chew. That this chewing is carried out by means of an extensive side-to-side movement of the mandible we find, I think, fully illustrated in the form of their palates and teeth. This completes the evidence already derived from an inspection of the muscular attachment on their skulls and the form and build of their lower jaws.

Their palates are broad and of the horseshoe shape typical of the Mousterian palatal form. The measurements of five very large Eskimo palates give an average palato-maxillary length of 55 m.m. and breadth of 71 m.m. This will show the

[1] See "Ancient Hunters, "by Prof. W. J. Sollas.

great width of these palates, as compared with their length. (The palato-maxillary length in these cases has been measured from the mid-point of a line drawn across the hinder borders of the maxillary bones, to a point between the anterior margins of the central incisors; hence this measurement is not strictly comparable with those given by Dr. Keith as the measurements for the Heidelberg, Gibraltar, and Jersey specimens). The form of the palate in the Eskimo skull No. 1 illustrated here (see Plate IV), is very typical of this horseshoe shape, and is very similar to the palatal shape of the Gibraltar skull. As we have already seen, the biting and chewing muscles are all in a high state of development in the Eskimo skulls, while the external pterygoid plates are noticeably large. Now the external pterygoid muscles are the direct agents in the side-to-side grinding movement. If the muscles on one side act, the corresponding side of the jaw is drawn forward, and the other condyle remaining comparatively fixed, the symphysis deviates to the opposite side. The alternation of these movements on the two sides produces trituration. When we turn to the teeth, although the roots do not show that degree of specialization to which those of Mousterian man had arrived, yet the form which the wearing down of their crowns takes is very noteworthy. All the teeth are in the adult very much worn down by attrition, the incisors and canines just as much as, and sometimes even more than, the others. This appearance is due to the fact that in this race, as indeed is the general rule among all races living under primitive conditions of food and cookery, the lower incisors are in apposition to those in the upper jaw and do not, as in civilized races, bite behind them.[1] Hence, in a side-to-side grinding movement of the mandible, accompanied, as it will necessarily be, by antero-posterior movements as well, the surface of the incisors would play over each other to the same extent as those of the molars; in addition to which must be taken into consideration also the wear occasioned by the meeting of these teeth in biting movements of the jaws.

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[1] See "Craniology of Australians with reference to dentary arcade," by Sir William Turner, Journ. Anat. and Phys., 1891.

The molar and bicuspid teeth in many instances present a very remarkable appearance. This is, in the case of the upper set, evidence of wear mainly on the lingual side, in the lower, mainly on the labial. Taking, for instance, a first molar that has been in use many years and is much worn down, the resulting shape is very peculiar. In the case of an upper tooth, a sharp high edge is present on the outer or labial margin, while on the lingual or inner margin the worn crown slopes sharply away from this edge, sometimes, indeed, right down to the alveolar border. An opposing lower tooth from such a skull would show a wearing away in exactly an opposite direction, although never to such a pronounced degree as in the upper tooth. Of the molar teeth, the first is usually the most advanced in this condition, the second and third less so, as one proceeds backwards. The second bicuspid also shows a high degree of this oblique wear, the first rather less, the canine scarcely any at all, its worn surface being more or less flat, while the surface of the incisors is usually flattened also. This appearance is not peculiar to the teeth of the Eskimo. I have noted it in certain American Indian skulls—in particular, two skulls from the interior of British Columbia and one from Ontario—and it is quite possible that it may be found in skulls from other regions or races where local conditions of diet, methods of mastication, and palatal shape, combine to produce conditions similar to those found among the Eskimo. For among the Eskimo this oblique wear of the teeth seems to be of quite common occurrence. It is probably due, I think, to the crushing and grinding chewing movements of their jaws combined with the broad horseshoe palate typical of their race. The deviation forwards and sideways of their mandibles in the process of chewing must be extensive and carried out with their biting muscles, powerful as we have seen them to be, in a high state of contraction in order to assist in crushing and grinding the food in process of mastication. The result probably is that in the forward and sideward movements of the mandible—and this more especially in the case of a palate of typical horseshoe form—the outer margins of the centro-lateral teeth of the lower set are brought into hard grinding contact with the inner sides of the

opposing teeth in the upper jaw, this resulting in an oblique wear to the teeth constituting the central portion of the lateral curve of the palate.

Again, as in the side-to-side chewing movements of the jaws, it is just these teeth that bear most of the sideways strain, it is only to be expected that a broad horseshoe type of palate should be practically universal in the skulls of this race. Moreover, since it is upon the centro-lateral teeth that so much side strain must fall and since the first molar is usually at the centre of the lateral curve, it is interesting to note that in many cases the lingual root of this tooth is very large and divergent, this being evidently an adaptation to the strenuous side-to-side method of mastication and affording a stout, buttress-like support to the tooth in question. In Plate II, figures 1 and 2, the lingual root of the first molar will be seen projecting out into the palate to a remarkable extent.

From all this evidence that I have been able to adduce, I think it will now be readily granted:—

(1) That the food of the Eskimo is of an extremely tough nature and must need thorough mastication by very strong jaws.

(2) That these people do indeed possess immensely powerful jaws, and are from a very early age accustomed to make use of a strongly developed chewing method for the trituration of the tough substances constituting their ordinary diet.

(3) That not content with the ordinary severe chewing use to which their jaws must be put, they regard as bonne-bouches substances which no ordinary jaws and teeth could make any impression upon; added to which the chewing power of their jaws is, in the case of the women, made use of in the manufacture of their garments from the skins of animals, etc.

(4) That this chewing is, in the main, a widely extensive side-to-side movement of the mandible and reacts in varying degrees of intensity upon the form of their crania, mandibles, palates, and teeth.

In conclusion, therefore, I think it probable that we have the following factors to deal with: (1) The free and extensive antero-rotary movements of the condyles necessary in this

method of mastication, and carried out with the powerful biting muscles in a high state of contraction. (2) The fact that the whole process is begun at a very early age. This second consideration is of great importance, as it is in the young growing skull that environmental reactions produce a lasting effect. Finally, the pressure of the condyle on the eminentia articularis has resulted in the prevention of the downward development of the latter, and has rolled and flattened it out in the manner presented to us so frequently in their skulls.

In the anthropoid ape the glenoid fossa is shallow and the eminentia articularis flattened (see figures 9 and 10, Plate II), but this cannot be put down to a side-to-side movement in mastication, as Dr. Keith has pointed out its impossibility in their case; it may possibly be due to the very heavy mandible and, proportionately to the size of the cranium, huge condyles, combined with extensive forward movements of the condyles in opening and closing the mouth and an antero-posterior movement of the same in mastication.

To sum up, then, in any primitive race where the food is tough, cookery imperfect, and strenuous side-to-side mastication needed, we should, I think, expect to find examples of shallow glenoid fossae, but in none of them would this be so marked or so universal as in a race such as the Eskimo, living almost exclusively upon a diet of tough and poorly cooked flesh.

In modern highly civilized man, on the other hand, where, owing to the soft well-cooked nature of the food, such strenuous masticatory movements are no longer necessary, a scissor-like snapping action of the teeth being substituted for the vigorous side-to side grind of primitive man, the condyles in the action of trituration need never move far or with great force out of the glenoid fossae; while, owing to the small extent to which the jaws diverge in the act of mastication, and to the absence of any necessity for powerful biting movements, the condyles of the mandible during mastication need never press with that hard rolling action upon the eminentia articularis. Hence in these races we find a deep glenoid fossa and a high and prominent eminentia articularis.

We are likely, I think, to find the same condition in any race or section of any race where the food is soft, either owing to its nature or the method by which it is prepared for consumption, and this whether the race is ancient or modern, primitive or civilized, white, black, or brown in colour. It seems to be simply a question of diet and cookery. Again, it is likely that even in members of the same race marked differences may be found, due to local conditions of diet, and it is quite probable too that, for instance, members of the same tribe may differ to a certain degree owing to individual characteristics. Still, I think the broad fact remains that in any race or in any ethnic group where the food or method of preparing it is such that strenuous mastication is required, the glenoid fossae of the individuals constituting that race or group will in general display a shallowness not met with amongst peoples enjoying softer conditions of diet.

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## Acknowledgments.

For the photographs in Plates III and IV and for material made use of in preparing the sections illustrating Plates I and II, I am indebted to the courtesy and kindness of Dr. Arthur Thomson, Professor of Human Anatomy of Oxford University. The specimens illustrated are in the cranial collection of the Oxford University Museum.

## EXPLANATION OF PLATE I.

Section through the left Glenoid Fossa of a European.

C = Condyle of lower jaw.
E = Eminentia articularis.
F = Glaserian fissure.
G = Anterior concave portion of glenoid fossa.
P = Petrous portion of temporal bone.
S = Squamous portion of temporal bone.

The above section was cut in the sagittal plane a little to the left of the deepest part of the Glaserian fissure. It will explain the diagrams drawn from the sections of the casts of various Glenoid Fossae shown in figure 2, as it illustrates the relations of the parts of the skull at that point. The lines EGF in Plate II. correspond in position in the skull to the line EGF in Plate I. In these diagrams the fossa has been drawn in its natural position, i.e. with the skull placed upright. In order to recognize the term 'concave' as applied to this fossa in its anatomical description, and the 'height' of the eminentia articularis, it is only necessary to turn the diagrams upside down.

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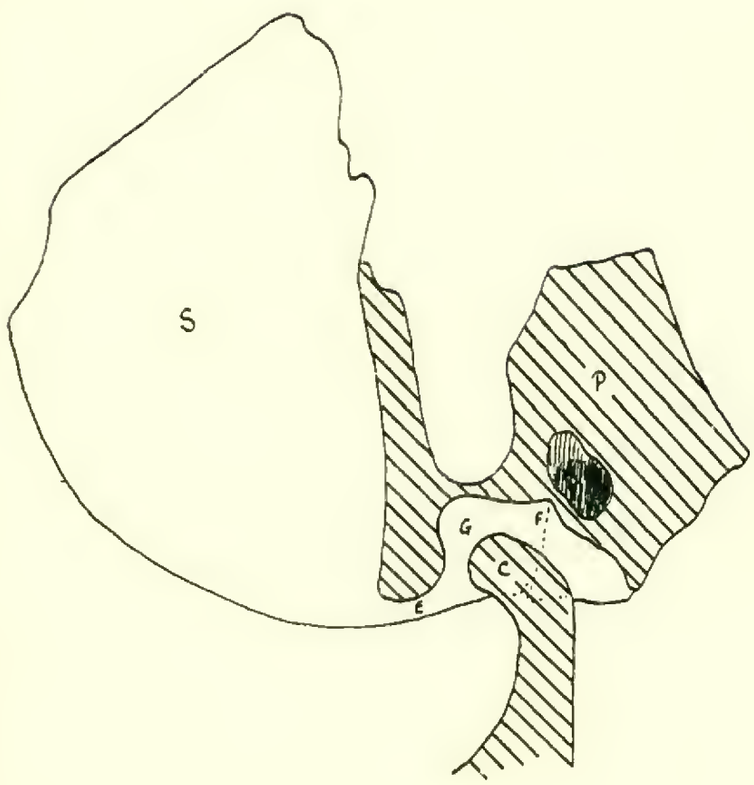

S
P
G
F
C
E

## Explanation of Plate II.

Sections through left Glenoid Fossae (natural size.)

E = Eminentia articularis.
C = Glenoid fossa.
F = Glaserian fissure.

1. European, adult ♂
2. European, adult ♂
3. Eskimo, adult ♂
4. Eskimo, adult ♂
5. Eskimo, adult ♀
6. Australian native, adult ♂
7. Australian native, adult ♂
8. Sinhalese, adult ♂
9. Chimpanzee, adult ♀
10. Gorilla, adult ♂

Casts were taken of the left glenoid fossa in a series of crania. These casts were then sawn through in the sagittal plane a little to the left of the deepest part of the Glaserian fissure. This corresponded approximately to the middle of the glenoid fossa. From the section of the fossa and eminentia articularis thus obtained, the above diagrams were drawn: one section of each cast was placed flat upon the paper, and a pencil run round the edge, starting from just behind the Glaserian fissure and ending at the anterior limit of the eminentia articularis.

Nos. 1 and 2 illustrate the deep glenoid fossa and high and prominent eminentia articularis in modern civilized man.

Nos. 3, 4, and 5 illustrate the shallow fossa and flattened eminentia in the Eskimo.

Nos. 6 and 7 are examples of shallow fossæ in two Australian crania.

No. 8 is a section through the glenoid fossa of a Sinhalese from Ceylon and is remarkable for its depth. This is what one would expect from a people who subsist mainly upon a vegetarian diet.

Nos. 9 and 10 illustrate the shallowness of this fossa in the anthropoid apes.

## Explanation of Plate II.

Sections through left Glenoid Fossae (natural size.)

E = Eminentia articularis.
G = Glenoid fossa.
F = Glaserian fissure.

1. European, adult ♂
2. European, adult ♂
3. Eskimo, adult ♂
4. Eskimo, adult ♂
5. Eskimo, adult ♀
6. Australian native, adult ♂
7. Australian native, adult ♂
8. Sinhalese, adult ♂
9. Chimpanzee, adult ♀
10. Gorilla, adult ♂

Casts were taken of the left glenoid fossa in a series of crania. These casts were then sawn through in the sagittal plane a little to the left of the deepest part of the Glaserian fissure. This corresponded approximately to the middle of the glenoid fossa. From the section of the fossa and eminentia articularis thus obtained, the above diagrams were drawn: one section of each cast was placed flat upon the paper, and a pencil run round the edge, starting from just behind the Glaserian fissure and ending at the anterior limit of the eminentia articularis.

Nos. 1 and 2 illustrate the deep glenoid fossa and high and prominent eminentia articularis in modern civilized man.

Nos. 3, 4, and 5 illustrate the shallow fossa and flattened eminentia in the Eskimo.

Nos. 6 and 7 are examples of shallow fossae in two Australian crania.

No. 8 is a section through the glenoid fossa of a Sinhalese from Ceylon and is remarkable for its depth. This is what one would expect from a people who subsist mainly upon a vegetarian diet.

Nos. 9 and 10 illustrate the shallowness of this fossa in the anthropoid apes.

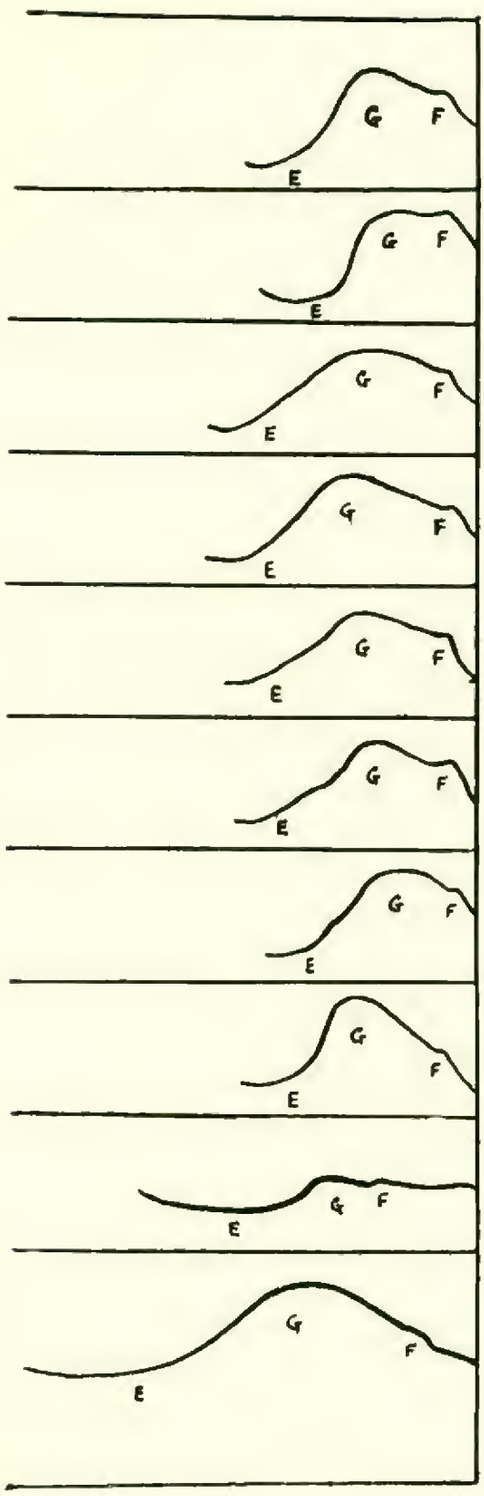



Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

Figure 7

Figure 8

Figure 9

Figure 10

Three Eskimo mandibles illustrating the lowness and strength of the coronoid process, and the width and massive build of the ascending ramus, characters typical of the lower jaws of this race.

## Explanation of Plate III.

Three Eskimo mandibles illustrating the lowness and strength of the coronoid process, and the width and massive build of the ascending ramus, characters typical of the lower jaws of this race.

A.

B.

C.

C.

west of the most teeth.

A. Eskimo adult, male.

B. Eskimo adult, female.

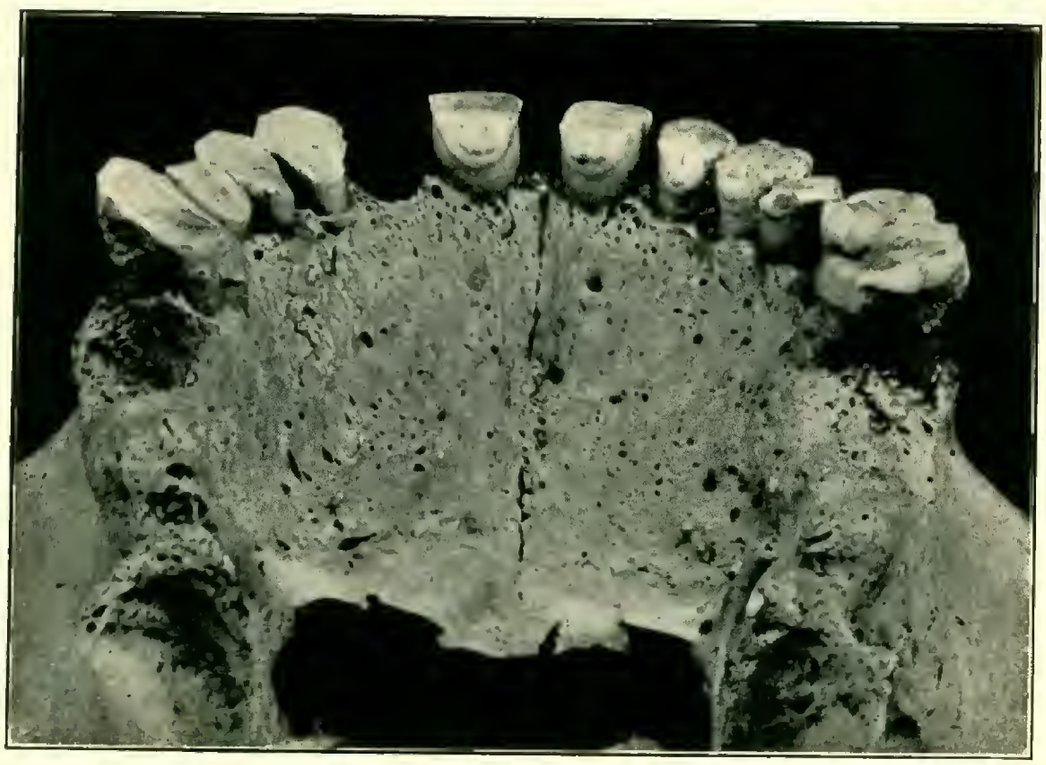
Two Eskimo heads illustrating great breadth of head and oblique

## Explanation of Plate IV.

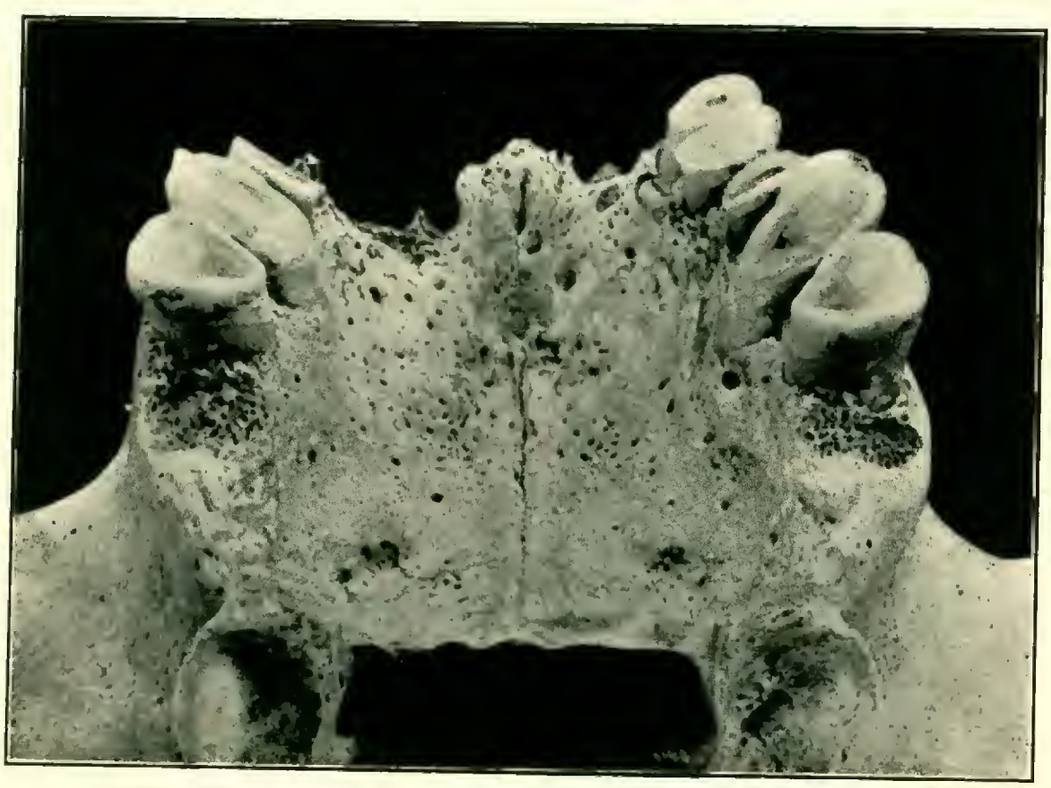
Two Eskimo palates illustrating great breadth of palate and oblique wear of the molar teeth.

A. Eskimo adult, male.

B. Eskimo adult, female.



A.



B.

The first number of the Museum Bulletin was entitled, *Victoria Memorial Museum Bulletin Number 1.*

The following articles of the Anthropological Series of Museum Bulletins have been issued.

*Anthropological Series.*

1. The archæology of Blandford township, Oxford county, Ontario; by W. J. Wintemberg.

2. Some aspects of puberty fasting among the Ojibwas; by Paul Radin.

3. Pre-historic and present commerce among the Arctic Coast Eskimo; by V. Stefansson.